

CURRICULUM VITAE

FLEMMING BESENBACHER

Name: Flemming Besenbacher
Date of Birth: 4th October 1952
Marital status: Married to Bente Besenbacher
Children: Søren, born 1981, and Pia, born 1984
Position: Professor at the Department of Physics and Astronomy, University of Aarhus, and Director of the Interdisciplinary Nanoscience Center, iNANO, University of Aarhus
Work address: Interdisciplinary Nanoscience Center, iNANO
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Academic experience: 1978 Graduated from the Dept. of Physics, University of Aarhus
1978-1979 Junior Research Fellow, Dept. of Physics, University of Aarhus
1980-1981 Senior Research Fellow, Dept. of Physics, University of Aarhus
1982 & 1983 Visiting scientist, Sandia National Laboratories, Albuquerque
1982-1986 Associate Professor, Dept. of Physics, University of Aarhus
1986-1989 Associate Research Prof. by the Danish Council for Research Policy
1989-1995 Associate Professor, Dept. of Physics, University of Aarhus
1994 D.Sc. University of Aarhus
1993-2003 Vice-director of Center for Atomic-scale Materials Physics (CAMP)
1996 Full Professor, Dept. of Physics and Astronomy, University of Aarhus
1997 Summer Guest Professor, Lawrence Berkeley National Laboratory, University of California, Berkeley, USA
2002- Director of Interdisciplinary Nanoscience Center (iNANO)
2002- Director of the iNANO graduate school, iNANOSchool
2005- Director of the NANOFOOD consortium
2009 Director of the Sino-Danish Center of Excellence “Center for Molecular Nanostructures on Surfaces (CMNS)”

Research awards: 1986 Awarded Research Associate Professor by the Danish Council for Research Policy
1995 The Danish Physical Society’s Research Prize, the NKT prize, for research achievements in surface science using scanning tunnelling microscopy
1993 Co-recipient of a research award for a center of excellence: Center for Atomic-scale Materials Physics (CAMP) by the Danish National Research Foundation (1993-2003)
1998 The award for CAMP extended for five more years (1998-2002)
1996 Elected Fellow of The Danish Academy of Natural Sciences (DNA)
1997 Elected Fellow of The Danish Academy of Technical Sciences (ATV)
1997 Elected Fellow of “Det Lærde Selskab” (the Society of Science and Letters), University of Aarhus
1998 Elected Fellow of The Royal Danish Academy of Sciences and Letters
2000 Elected member of the Scientific Advisory Board der Max-Planck-Institut für Festkörper-forschung, Stuttgart
2000 Schuit distinguished Lecturer, University of Eindhoven

- 2001 Co-recipient of a research award for a center of excellence: “Nanoscience and Tissue Engineering approaches to improved biocompatibility”
- 2001 Elected Fellow of the Institute of Physics
- 2002 Co-recipient of a research award for a center of excellence: “Towards a new hydrogen economy”
- 2002 Elected Fellow of the Institute of Nanotechnology
- 2003 Villum Kann Rasmussen’s award for outstanding research achievements in science and great efforts within the new area of nanotechnology (VELUX Foundation)
- 2003 University of Aarhus Anniversary Foundation Award for outstanding academic research within the area of surface and nano-science
- 2003 Richard A. Glenn Award for best paper at the Fuels Chemistry Division Spring Symposia, American Chemical Society
- 2004 Appointed EU project ambassador for the Aarhus Municipality EU Office in Brussels, Belgium
- 2004 Danmarks Naturvidenskabelige Akademis Industripris 2004 (Industrial prize of the Danish Academy of Natural Sciences 2004)
- 2004-2014 Honorary Professor, Aalborg University
- 2006 Grundfos award for outstanding nanoscience research
- 2007 Professor Honoris Causa from Henan University, China
- 2007 Professor Honoris Causa from Tianjin University, China.
- 2007 Knighted by the Danish Queen
- 2008 Professor Honoris Causa from Huazhong Normal University, China
- 2008 Professor Honoris Causa from Jilin University, China
- 2008 Professor Honoris Causa from Zhejiang University of Technology
- 2008 Bird-Steward-Lightwood Lectureship award at the Dept. of Chemical and Biological Engineering at University of Wisconsin-Madison
- 2008 Recipient of one of the prestigious ERC advanced research grants from the European Research Council
- 2009 Aarhus Business Award 2009
- 2009 Honorary Guest Professor at Institute of High Energy Physics, Key Laboratory for biomedical effects of Nanomaterials and Nanosafety, Chinese Academy of Sciences
- 2009 Recipient of the prestigious Einstein Professorship, Chinese Academy of Sciences
- 2009 Elected Honorary Fellow of Chinese Chemical Society
- 2009 Elected Honorary Fellow of the American Vacuum Society
- 2009 Recipient of a Sino-Danish Center of Excellence “Center for Molecular Nanostructures on Surfaces CMNS” from the Danish National Research Foundation
- 2009 Honorary Professor of ICCAS, China

Leadership:

- 1993-2002 Vice-director of the center of excellence: “Center for Atomic-scale Materials Physics” (CAMP) sponsored the Danish National Research Foundation
- 1994-1997 Head of the “Minicenter for Nanotribology” established under the Danish Materials Research Programme
- 1996-2000 Chairman of the board of the Institute for Storage Ring Facilities Aarhus (ISA), University of Aarhus
- 1999 Member of the advisory board at “Image Metrology Aps”
- 2000 Member of expert committee in EU on Nanotechnology in relation to the 6th Framework Programme
- 2001 Head of scientific advisory committee on nanotechnology for the Danish Research Ministry
- 2001 Member of advisory committee on nanotechnology for the Danish Ministry of Education
- 2001 Appointed the Danish representative of the COST-Nanoscience (COST

- European Co-operation in the field of Scientific and Technical Research)
- 2001 Appointed Danish representative of the PESC (Physical and Engineering Sciences) unit under ESF (European Science Foundation)
- 2002 Director of the Interdisciplinary Nanoscience Center (iNANO) at the University of Aarhus (www.inano.dk)
- 2002 Director of the iNANO graduate school (iNANOSchool), University of Aarhus (www.inanoschool.dk)
- 2003 Head of the Danish National Nano-network and Instrument Centre
- 2004 Danish representative on the EU Programme Committee for the 7th Framework Programme
- 2005 Member of the Board of Directors of the Carlsberg Foundation (2005-)
- 2005 Member of the Board of Directors of the Carlsberg research Laboratories (2005-)
- 2005 Member of Board of Directors of Carlsberg A/S (2005-)
- 2005 Board member of the Board of Directors of the Tuborg Foundation
- 2005 Director of the NANOFOOD consortium
- 2008 Board member of the MedTech Innovative Center, Aarhus, Denmark
- 2009 Director of the Sino-Danish Center of Excellence “Center for Molecular Nanostructures on Surfaces (CMNS)”
- 2009 Appointed member of reference group for the FP7 theme Nanosciences, Nanotechnologies, Materials and New Production Technologies by the Danish Agency for Science, Technology and Innovation

Research

Administration:

- The Danish Natural Science Research Council (1998-2004)
- The Scientific Commission for Physics and Chemistry under the Danish Technical Research Council (1996-2000)
- The Programme Committee for the Materials Programme under the Danish Research Ministry (1999)
- The steering committee for the Center for Surface Reactivity under the Danish Materials Research Programme (1994-1997)
- The board of the Faculty of Science, University of Aarhus, (2001-)
- The Strategy Committee for the Faculty of Science, University of Aarhus (2000)
- The Research Committee for Faculty of Science, University of Aarhus (2000-)
- The Board of the Department of Physics and Astronomy, University of Aarhus (1988-92, and 1999-2004)
- The VIP Advisory Board, Department of Physics and Astronomy, Univ. of Aarhus (2004-)
- PhD evaluation and steering committee at the Department of Physics and Astronomy
- The Board of the Danish Physical Society (1990-1994)
- The Board of Solid State Section of the Danish Physical Society (1994-1999)
- The International Advisory Board and Programme Committee for European Conferences on Surface Science
- International Advisory Board for the Conf. on Scanning Tunneling Microscopy, International Conf. on Scanning Probe Spectroscopy
- Chair of the Programme Committee for NANO-7 & ECOSS-21
- International Advisory Board of ECOSS-22
- International Program Committee of the ASEVA Summer School 2004
- Scientific Committee of the Fifth Nordic Conference on Surface Science (Finland 2004)
- International Advisory Committee of ISSS-4 (2004 - 2005)
- Topsøe Catalysis Forum (2004-)
- IVS Advisory Board on Nanotechnology (2004-)
- International Scientific Advisory Committee of the 16th International Microscopy Congress in Sapporo 2005

Scientific and Industrial Advisory board of NanoBio-Europe conference 2005-2007
Advisory Board of NanoBio-Europe Conference 2005,
Scientific Advisory Board, Centre for Molecular (Bio) medicine, Trieste, Italy
(2005-)
Veeco Technical Advisory Board
National censor team for engineering education
Danish National Network for the 7th EU Framework Programme
International Advisory Committee of ISSS-5 (2008)
International Organizing Committee of NTNE08
Scientific Advisory Committee, NANOMAT Programme
Member of international evaluation committee of MESA+
Advisory Board of ECOSS 26 (2009)
Visiting Committee, Commissariat à l'Énergie Atomique (2009)
Member of Nano Today Editorial Advisory Board
Scientific committee member of International Conference of Nanotechnology:
Fundamentals and Applications 2010

Member of:

The Danish Physical Society
The European Physical Society
The American Physical Society
The American Chemical Society
The American Materials Research Society
The Institute of Nanotechnology
The Institute of Physics

Editorial board of:

Chemical Physics Letters (1996-2000)
Surface Review and Letters (1998-)
Probe Microscopy (1999-)
Progress in Surface Science (1999-2008)
Journal of Nanoscience and Nanotechnology (2001-)
Journal of Nanoscience (2002-)
Journal of Physics - Condensed Matter (2001-)
Surface Science (2003-2008)
Nanoletters (2003-)
Small (2004-)
Journal of Nanotechnology (2004-2008)
Journal of Scanning Probe Microscopy (2006-2008)
Physical Review Letters (2006-2008)
Nanoscale Research Letters (2006-)
Nano Today (2006-)
Journal of Nano Education (2007-2009)
Open Condensed Matter Physics Journal (2007-)
NANOMEDICINE: Nanotechnology, Biology and Medicine (2008-)
ACS-NANO (2008-)
Advanced Biomaterials

Referee for:

Science, Nature , Nature Materials, Nature Nanotechnology, Phys. Rev. Letters,
Phys. Rev. B, JACS, ACS-NANO, Surface Science, Jour. Chem. Phys., Langmuir,
Angewandte Chemie, Nanotechnology, NanoLetters, Europhysics Letters,
Chemical Physics Letters, Surface Review and Letters, Probe Microscopy; Progress
in Surface Science, European Research Council, European Commission (European
Research Excellence)

I have been referee for larger research proposal for the research councils in Japan,
US, Sweden, Italy, Netherlands, Switzerland, Ireland, Germany, Austria and
Norway.

Invited talks:	At international conferences: app.159 since 1990 At research institutions and universities: app. 90 since 1990
Larger Research Grants (> 100,000 Euros):	Center for Molecular Nanostructures on Surfaces (CMNS), Danish National Research Foundation, 2,016,129 Euros
	Center for Atomic-Scale Surface Science (CASS), Villum Kahn Rasmussen Foundation, 1,344,086 Euros
	Antifouling fish - reducing bacterial contamination during food production, Danish Ministry of Agriculture, Fisheries and Food, 375, 400 Euros
	Individualized Musculoskeletal regeneration and Reconstruction Network, Danish Ministry of Agriculture, Fisheries and Food, 288,579 Euros
	NanoNonWovens, Danish National Advanced Technology Foundation, 1,151,600 Euros
	Cement of the future – building materials of the future - FUTURECEM, Danish National Advanced Technology Foundation, 1,342,300 Euros
	Protein-based functionalisation of surfaces, Danish National Advanced Technology Foundation, 2,006,700 Euros
	Mobile measurements of oil quality - OnBoard NMR, Danish National Advanced Technology Foundation, 1,786,100 Euros
	Novel materials for hydrogen storage, the Danish Council for Strategic Research, 335,570 Euros
	Interdisciplinary projects in nanoscience, the Danish Council for Strategic Research, 2,013,400 Euros
	Bioimaging using nanoparticles, the Danish Council for Strategic Research, 1,159,700 Euros
	New metal-oxide and -sulphide catalysts, the Danish Council for Strategic Research, 1,072,900 Euros
	Center for surface reactivity, the Danish Natural Science Research Council, 805,400 Euros
	High-pressure STM chamber for catalysis, the Danish Natural Science Research Council, 456,400 Euros
	Studies of catalytic properties of metal-oxide and –sulphide surfaces and nanostructures, Lundbeck Foundation, 1,81,000 Euros
	Development of improved catalysts, Haldor Topsoe, 203,000 Euros
	Studies of model catalysts with Atomic Force Microscopy, Haldor Topsoe, 483,200 Euros
	Anti-biofouling nanostructured surfaces for the slaughter- and dairy sectors, the Danish Pig Levy Fond and the Danish Milk Levy found, 335,570 Euros
	Centre for NeuroEngineering (CNE), the Research Council for Technology, 230,300 Euros

Cross-institutional, interdisciplinary projects in nanotechnology and nanoscience at University of Aarhus and Aalborg University, Danish Agency for Science, Technology and Innovation, 3,350,000 Euros

Innovation consortium, MiNAP, Ministry of Science, Technology and Development, 302,000 Euros

Chitosan-based nanoparticles and membranes for biomedicine, Ministry of Science, Technology and Development, 483,220 Euros

The hydrogen society, the Research Council for Technology and Production, 1,054,000 Euros

Nanoscience and tissue engineering approaches to improved biocompatibility and biointegration and implants, Danish Medical Research Council, 918.000 Euros

New design strategies for catalysts, the Danish Research Council for Technology and Production, 441,600 Euros

Center for Atomic Scale Materials Physics (CAMP), Danish National Research Foundation, 5,000,000 Euros

The graduate school, (iNANOschoo), Public and private funding, 4,005,000 Euros

EU Grants:

ERC, Advanced research grant, European Research Council, 1.400,000 Euros

Computing inside a single molecule using atomic scale technology, Pico-Inside, EU, FP6, Integrated Project, 271,700 Euros

Nanoscience targeted at life sciences (Frontiers), EU, FP6, Network of Excellence, 422,500 Euros

Molecular Networks at Phase Boundaries, EU, Marie Curie Training network, 417,800 Euros

Training and Mobility of Researchers (TMR) Programme, Manipulation of individual atoms and molecules with the STM (1997-)

Information Society Technology, Bottom-Up-Nanomachines (BUN)

Research Training Networks, Reactivity of clean and modified oxide surfaces (OXIDESURFACES)

Research Training Network, Atomic and molecular manipulation as a new tool for science and technology (AMMIST)

STREP under the 6th Framework, Nanocues

Supervision:

I have supervised 26 PhD students and am currently supervising 13 PhD students. I have supervised 18 Master of Science students.

Since 1994 I have been a member of the PhD Committee at the Department of Physics and Astronomy and as such been head of the evaluation committee at more than 20 PhD exams.

Since 2003 I have been the director of the graduate school, iNANOschoo, in which 122 PhD students are currently enrolled.

Publication statistics:

As per August 2009, my publication list contains more than 400 entries in

international, refereed journals, including:

Book chapters and reviews: 20

Nature: 3

Nature Materials: 3

Nature Nanotechnology 1

Science: 10

Phys. Rev. Lett. (PRL): 48

Journal of Applied Physics (J. Appl. Phys.): 9

Applied Physical Letters: 6

JACS: 13

My published articles have been cited 11,406 times, and my H-index is 60

Selected publications:

1. P.T. Sprunger, L. Petersen, E.W. Plummer, E. Lægsgaard and F. Besenbacher, Giant Friedel oscillations on the Be(0001) surface, *Science* 275 (1997) 1764
2. F. Besenbacher, I. Chorkendorff, B.S. Clausen, B. Hammer, A. Molenbroek, J.K. Nørskov and I. Stensgaard, Design of a surface alloy catalyst for steam reforming, *Science* 279 (1998) 1913
3. S. Horch, H.T. Lorensen, S. Helveg, E. Lægsgaard, I. Stensgaard, K.W. Jacobsen, J.K. Nørskov and F. Besenbacher, Enhancement of surface self-diffusion of platinum atoms by adsorbed hydrogen, *Nature* 398 (1999)
4. Kühnle et al., Chiral recognition in dimerization of adsorbed cysteine observed by scanning tunneling microscopy, *Nature* 415 (2002) 891
5. F. Rosei, M. Schunack, P. Jiang, A. Gourdon, E. Lægsgaard, I. Stensgaard, C. Joachim, and F. Besenbacher, Organic molecules acting as templates on metal surfaces, *Science* 296 (2002) 328
6. R. Otero, F. Hümmelink, F. Sato, S.B. Legoas, P. Thostrup, E. Lægsgaard, D.S. Galvão, I. Stensgaard, and F. Besenbacher, Lock-and-key effect in the surface diffusion of large organic molecules probed by STM, *Nature Materials*, *Nature Materials* 3 (2004) 779
7. R.T. Vang, K. Honkala, S. Dahl, E.K. Vestergaard, J. Schnadt, E. Lægsgaard, B.S. Clausen, J.K. Nørskov, and F. Besenbacher, Controlling the catalytic bond-breaking selectivity of Ni surfaces by step blocking, *Nature Materials* 4 (2005) 160
8. S. Weigelt, C. Busse, L. Petersen, E. Rauls, B. Hammer, K.V. Gothelf, F. Besenbacher og T. R. Linderoth, Chiral switching by spontaneous conformational change in adsorbed organic molecules, *Nature Materials* 5(2006) 112-117
9. D. Matthey, J.G. Wang, S. Wendt, J. Matthiesen, R. Schaub, E. Lægsgaard, B. Hammer and F. Besenbacher, Enhanced bonding of gold nanoparticles on oxidized TiO₂(110), *Science* 315 (2007) 1692-, Enhanced bonding of gold nanoparticles on oxidized TiO₂(110), *Science* 315 (2007) 1692
- 10 S. Wendt, P.T. Sprunger, E. Lira, G.K.H. Madsen, Z. Li, J.Ø. Hansen, J. Matthiesen, A. Blekinge-Rasmussen, E. Lægsgaard, B. Hammer and F. Besenbacher, The role of interstitial sites in the Ti3d defect state in the band gap

of titania, Science 320 (2008) 1755,

Patents:

J.H. Hyldtoft, B.S. Clausen, F. Besenbacher, R.T. Vang, J.K. Nørskov, C.G.L. Olsen, E.K. Vestergaard: Fuel cell and anode, patent number 04012278.0

F. Besenbacher, E. K. Vestergaard, R. T. Vang, J.K. Nørskov, B.S. Clausen, J. Hyldtoft, C. Olsen: Carbon resistant anode materials for solid oxide fuel cells, application number PA 2003 00869, June 2003

F. Besenbacher, M. Foss, M.R. Duch, F.S. Pedersen: BioStructure Surface Arrays, application number PA 2005 00610 and US 60/675096, April 2005

F. Besenbacher, M. Foss, L.K. Andersen, M.R. Duch, J. Justesen, F.S. Pedersen: Biocompatible material for surgical implants, application number PA 2005 00981, April 2005

K.A. Howard, J. Kjems, F. Besenbacher, X.D. Liu. (2006) Nanoparticles for nucleic acid delivery Application No. PCT/DK2007/050084, Publication No. WO 2008/003329

K.A. Howard, J. Kjems, F. Besenbacher (2007). Chitosan/siRNA nanoparticles for treatment of inflammatory diseases. Application No. PCT/DK2008/050184

M. Andreasen, K.A. Howard, J. Kjems, F. Besenbacher (2007). Osteopontin-chitosan nanoparticles. Application No. PCT/DK2008/050179

M. Andersen, K.A. Howard, J. Kjems, F. Besenbacher (2007). Freeze-dried chitosan nanoparticles. Application No. PCT/DK2008050171

T. Broch-Nielsen, J. Bondergaard, F. Besenbacher, P. Kingshott, S. Moelgaard (2007): Superhydrophobic coating of a polymer nonwoven, in particular a polypropylene nonwoven, WO2007048630, DE102005051550.

T. Broch-Nielsen, J. Bondergaard, F. Besenbacher, P.Kingshott (2007): Material Comprising and consisting of fibres and nanoclay, WO2007048547, DE102005051844, EP1941083.

M.R. Duch, L. Markert, J. Lovmand, A.C. Füchtbauer, E.M. Füchtbauer, M. Foss, F. Besenbacher, F.S. Pedersen, PA 2008 00726

M. R. Duch, J. Lovmand, M. Foss, F. Besenbacher, F.S. Pedersen, PA 2008 00730.

S. Shipovskov, D. Sutherland, F. Besenbacher, B.S. Laursen (2008), Nanojelly, WO01/28328, WO97/20041, WO06/002630

K.A. Howard, I. Nawroth, J. Alsner, J. Overgaard, F. Besenbacher and J. Kjems (2008). Chitosan/siRNA nanoparticles as a treatment for radiation-induced fibrosis (RIF). DK PA 2009*****

Industrial Collaboration:

Co-founder of InvitroQ ApS
Senior advisor and consultant to Haldor Topsøe A/S
Member of the Haldor Topsoe Catalysis Forum advisory group
Member of the scientific advisory board for SCF Technologies A/S
Close collaboration with Danfoss A/s, Danfoss Bionics A/S, Grundfos A/S.
NANONORD A/S, Cation A/S, Danisco A/S, Arla A/S, Fibertex A/S, Image Metrology A/S
Board member of the MTIC Foundation, MedTech Innovation Center

Research Competences: Current research activities include the development and use of scanning tunneling microscopy, a variety of other surface sensitive techniques to study clean and adsorbate-covered surfaces, and synthesis and characterization of nanostructures on surfaces.

Research Areas: Nanoscience, nanotechnology, nanocatalysis, structure and reactivity of clean, adsorbate-covered and alloy surfaces, scanning tunnelling microscopy, atomic force microscopy, nucleation and growth of nanoclusters, interaction of hydrogen with defects in metals, hydrogen storage, quantized conductance in nanowires, different penetration phenomena, adsorption of bio-molecules at surfaces, biocompatibility, biosensors

CAMP: Upon international evaluation the center of excellence “Center for Atomic-scale Materials Physics” (CAMP), was funded by two consecutive five-year-period grants from the Danish National Research Foundation starting in 1993. Two international evaluation committees have not been sparse in their praise of CAMP, e.g.:

CAMP is an exceptionally effective research enterprise with a scientific and technical influence far out of proportion to its size. The research output is outstanding and CAMP scientists are recognized worldwide for their excellence. I can think of no other group in the world that compares to CAMP in excellence both in experiment and theory in their chosen field and the “benefit/cost” ratio is enormous” (excerpt from the second evaluation report, December 2002).

The full evaluation is available from the Danish National Research Foundation: www.dg.dk.